



## Volgenau School of Engineering

# BIOENGINEERING, B.S.

## 2017 - 2018

Bioengineering, or biomedical engineering, is the use of engineering techniques to solve problems in biology and medicine. Bioengineers design instruments, processes, and systems that assist in diagnosis of disease, aid individuals with disabilities, and monitor the infirm either at home or at a healthcare facility. They also conduct research, often in collaboration with life scientists, to learn about the basic causes of, and potential remedies for, medical conditions.

Medical practice today is unimaginable without technologies that diagnose through noninvasive imaging rather than cutting, allow performing surgery through small holes in the skin, enable active life in spite of heart disease, and rehabilitate those who lost an arm or their hearing. "Personalized medicine", envisioned to be based on the genomic analysis of individuals, relies on new computational approaches. Bioengineers play a major role in developing such technologies. Bioengineers have been involved in innovations such as pacemakers, orthopedic implants, diagnostic imaging techniques, cochlear implants, artificial pancreas, cartilage regeneration and prediction of drug effects.

Because of their interdisciplinary training, bioengineers play an increasing role in attacking some of the most pressing current health issues in the country. Bioengineers become part of the solution of these issues by developing devices, computational systems, technical aids, diagnostic tests, and therapies that are appropriate, effective, and affordable. The need for bioengineers has been projected to grow 23 percent from 2014 to 2024 ([www.bls.gov](http://www.bls.gov)). Among the prominent reasons is the increased role of technology in biological discovery, increased role of technology in medicine, and need to contain healthcare costs which is a vital part of the national economy.

The bioengineering program focuses on technologies: measurements, signal processing, computer science, and systems. It offers three concentrations: **Biomedical Signals and Systems**, **Health Care Informatics** and **Prehealth**. The program will prepare students for employment in industry and government as well as for advanced studies. Some bioengineers will seek admission to medical school; acceptance rate for them is higher than for most other disciplines. Career opportunities exist in the areas of basic research, product design, project engineering, engineering management and consultancy, technical sales, medicine and many others. The website <http://jobboard.bmes.org/jobs> gives a good description of careers in bioengineering.

The curriculum provides a strong background in the biological and engineering fundamentals of bioengineering as well as senior level courses in the emerging areas of biomedical system modeling, control of biomedical systems, and health care informatics. The curriculum includes twelve hours of senior technical electives and a Senior Design Project which may be used for further specialization.

### Admission Requirements

Admission to George Mason is competitive; the number of qualified candidates generally exceeds the number of new students who can be accommodated. An offer of admission is valid only for the semester for which the student applied. Application for undergraduate admission can be made online at George Mason's website <http://admissions.gmu.edu>. The Office of Admissions can also provide forms upon request.

### Freshman Requirements

The following factors are considered when reviewing applications for admission:

- Cumulative high school grade point average for course work completed in grades 9 through 12.
- Level of difficulty of course work elected throughout the high school years particularly in English, mathematics, laboratory science, and foreign language.
- Scores from the Scholastic Aptitude Test (SAT) and/or American College Test (ACT), and Test of English as a Foreign Language (TOEFL) if appropriate.

### Transfer Requirements

The university accepts qualified students who wish to transfer from other colleges. A transfer applicant who has completed at least 30 semester hours of transferable credit must submit two copies of official transcripts from each collegiate institution attended. Transfer applicants with fewer than 30 semester hours of transferable credit must also submit a copy of their secondary school record, as well as SAT or ACT scores.

# BIOENGINEERING, B.S.

## Degree Requirements

The curriculum requires 120 total credit hours, which can be completed within eight semesters. At least 45 semester hours of the degree requirements must be at the 300 level or above. Students may wish to consider an extra semester or two for the purpose of lightening the course load (particularly for those with part-time employment); participating in Cooperative Education (with local industry); pursuing a double major (for example with mathematics, computer science, or systems engineering); adding a minor (such as mechanical engineering, business, computer science or math); or adding extra courses to deepen their knowledge in engineering and/or the basic sciences.

## 2017-2018 Sample Schedule for Undergraduate Bioengineering majors

### First Semester

MATH 113 Analytic Geom. and Calculus I	4
CS 112 Intro to Computer Programming	4
ECON 103 <b>OR</b> PSYC 100 <b>OR</b> SOCI 101	3
ENGR 107 Intro to Engineering	2
Mason Core*	3
<b>Total</b>	<b>16</b>

### Second Semester

MATH 114 Analytic Geom. And Calculus II	4
BENG 101 Intro to Bioengineering	3
PHYS 160 University Physics I	3
PHYS 161 University Physics I Lab	1
CHEM 211+213 <b>OR</b> CHEM 251 Gen.Chem/ Engr	4
<b>Total</b>	<b>15</b>

### Third Semester

MATH 213 Analytic Geom. & Calculus III	3
MATH 203 Linear Algebra (BIOE section)	3
PHYS 260 University Physics II	3
PHYS 261 University Physics II Lab	1
BIOL 213 Cell Structure and Function	4
Mason Core*	3
<b>Total</b>	<b>17</b>

### Fourth Semester

MATH 214 Elem. Differential Equations	3
BENG 220 Physical Bases of Biomed Systems	3
BENG 313 Physiology for Engineers	3
PHYS 262 University Physics III <sup>2</sup>	3
PHYS 263 University Physics III Lab <sup>2</sup>	1
Mason Core*	3
<b>Total</b>	<b>16</b>

### Fifth Semester

Mason Core*	3
BENG 320 Bioengineering Signals & Systems	3
BENG 380 Intro to Circuits and Electronics	3
BENG 381 Circuits and Electronics Lab	1
CS 222 Computer Programming for Engineers	3
<b>OR</b>	
CS 211 Obj. Oriented Programming	
<b>Total</b>	<b>13</b>

### Sixth Semester

STAT 344 Probability & Statistics for Engineers	3
BENG 301 Bioengineering Measurements	3
BENG 302 Bioengineering Measurements Lab	1
BENG 304 Modeling & Control of Physiol. Syst.	3
ECE 301 Digital Electronics	3
Mason Core*	3
<b>Total</b>	<b>16</b>

### Seventh Semester

BENG 491 Bioengineering Senior Seminar I	1
BENG 492 Senior Advanced Design Project I	2
BENG 420 Bioinformatics for Engineers	3
Technical Elective <sup>3</sup>	3
Technical Elective <sup>3</sup>	3
ENGH 302 Adv Comp (Nat Sci section) ***	3
<b>Total</b>	<b>15</b>

### Eighth Semester

BENG 495 Bioengineering Senior Seminar II	1
BENG 493 Senior Advanced Design Project II	2
Technical Elective <sup>3</sup>	3
Technical Elective <sup>3</sup>	3
Mason Core*	3
<b>Total</b>	<b>12</b>

<sup>1</sup> All bioengineers will be required to register for a specific section of MATH 203 including a 1-hour recitation with practical applications.

<sup>2</sup> Students interested in Medical School (or other Professional health schools) may substitute CHEM 211 and CHEM 213 (or CHEM 211H + lab) and CHEM 212 and CHEM 214 (or CHEM 212H + lab) for PHYS 262, PHYS 263, and CHEM 251.

<sup>3</sup> Students choose from a list of approved technical electives, including one of the Technical Electives from an approved life science course.

\* <http://catalog.gmu.edu/mason-core> Mason Core Categories: One course from each: Oral Communication, ENGH101, Arts, Global Understanding, Literature, Western Civilization/World History. VSE students do not need to seek out Science, Math, and IT categories as they are built into the major curriculum.

\*\*\* ENGH 101 and Mason Core-Literature must be completed before taking ENGH 302.

**We invite requests for additional information. Please contact:**

Volgenau School of Engineering  
 Bioengineering Department  
 George Mason University, Mail Stop 1J7  
 3300 Nguyen Engineering Building, Fairfax, VA 22030-4444  
 Phone: (703) 993-5846 Fax: (703) 993-2077  
<http://bioengineering.gmu.edu> [bioeng@gmu.edu](mailto:bioeng@gmu.edu)